(11) (A) No. 1027501

(45) ISSUED 780307

(52) CLASS 196-24
C.R. CL.

(19) (CA) # CANADIAN PATENT

(54) METHOD FOR RECOVERY OF HYDROCARBON DILUENT FROM THE CENTRIFUGE TAILINGS OF A TAR SAND HOT WATER PLANT

(72) Simmer, Michael,
Canada

Granted to Her Majesty the Queen in right of Canada, as represented by the Minister of Energy, Mines and Resources; Her Majesty the Queen in right of the Province of Alberta; Ontario Energy Corporation; Imperial Oil Limited; Canada-Cities Service, Ltd. and Gulf Oil Canada Limited, Canada

(21) APPLICATION No. 201,812
(22) FILED 740606

(30) PRIORITY DATE

No. OF CLAIMS 3

ABSTRACT

This invention relates to the treatment of hot tailings from the dilution centrifuging circuit of a hot water process-type plant for recovering bitumen from tar sand. The tailings, containing naphtha diluent, are introduced to a vacuum flash vessel maintained at 3 - 5 psia. The diluent and water are recovered as an overhead product which may be settled to separate off the naphtha for recycling to the dilution centrifuging circuit.

This invention relates to a method for recovering hydrocarbon diluent from hot centrifuge tailings produced in the treatment of bitumen froth from the hot water process.

The known hot water process for recovering bitumen from tar sand, such as the Athabasca tar sand, has been extensively described in the literature. In general, the process involves mixing tar sand with hot water and steam in a tumbler to initiate a preliminary separation or dispersal of the bitumen and solids and to aerate the slurry so produced. The product from the tumbler is flooded with additional hot water to further separate the bitumen particles from the coarse sand particles and the fine clay and silt particles. This dilute stream is then fed to a cylindrical primary settler or cell having a conical bottom. Here, under quiescent conditions, the coarse sand particles settle out and are removed through an outlet at the base of the vessel. The bitumen, which has preferentially become attached to air bubbles, floats to the surface and forms a froth, which is recovered in a launder circumscribing the upper rim of the cell. A middlings stream is constantly withdrawn from the primary cell intermediate to its ends to remove water and fine solids. This middlings stream is treated in a sub-aeration flotation cell to recover contained bitumen as froth. This secondary cell froth stream, which is badly contaminated with water and solids, may be settled to separate off some of the contaminants; in any case, the secondary cell froth is normally combined with the primary cell froth to provide a product for further processing.

It is conventional to dilute the combined froth stream with a hydrocarbon diluent, preferably having an ASTM boiling range of approximately 140°F to 380°F, to improve the difference in specific gravity between the contained bitumen

and water and to reduce the bitumen viscosity, so that the stream is more amenable to centrifugal separation. Typically, the diluent-diluted froth comprises a mixture of hydrocarbon (67% by weight), water (26% by weight), and solids (7% by weight). This stream is fed to a solid scroll centrifuge machine, to separate and remove substantially all the coarse solids as an underflow stream. The overflow stream from the scroll machine is passed through a disc-type centrifuge machine to separate the water and fine solids from the bitumen and thereby produce a hydrocarbon product which is amenable to upgrading.

The solids-rich underflow streams from the scroll and disc centrifuges are combined and normally discarded into the extraction plant settling pond system. However, these tailings include about 2% by weight hydrocarbon diluent. The loss of diluent in this manner is expensive; equally of concern, however, is the safety risk which it poses. More particularly, the water in the settling system is eventually recycled to the flotation operation. It has been found that at least part of the diluent remains occluded in the water and, when re-heated in the plant, can create explosive conditions.

With the foregoing background in mind, it is therefore the primary object of this invention to provide a process for recovering the major portion of the hydrocarbon diluent contained in the centrifuge tailings.

It is another object to recover the diluent in a manner which is relatively inexpensive.

In accordance with the invention, the hot (about 170°F) combined tailings stream issuing from the scroll and disc centrifuges is introduced into a flash vessel maintained at sub-atmospheric pressure, preferably about 2 - 10 psia, and more specifically about 3 - 5 psia. The major portion of the diluent is vaporized, together with some water. The flash vapor

is removed and cooled to liquify its components, which are collected in an accumulator. The water and diluent may be separated by settling. The diluent is recycled to the process while the water may be discarded into the settling pond of the extraction plant.

The drawing is a schematic diagram illustrating a circuit which may be used to carry out the method.

The invention is now described with reference to an example and the drawing. A stream 1 of hot centrifuge tailings, comprising 56,000 lbs/hr of bitumen, 39,200 lbs/hr of naphtha diluent, 1,653,000 lbs/hr of water, and 42,900 lbs/hr of solids, is fed to a vacuum flash tower A by a vacuum ejector B. The vacuum flash tower is maintained at a pressure of 3.5psia and a temperature of 143°F. A stream 2 of steam is introduced to the flash tower to provide 1.1 million BTU's/hr.

The overhead stream 3 from the vacuum flash tower is passed through a condenser-~~cooler~~ cooler C to cool the stream to about 90°F; the liquid product, comprising 34,000 lbs/hr of naphtha and 21,300 lbs/hr of water, is collected in the accumulator D. The water settles within the accumulator boot D1 and the naphtha floats over the water layer, from whence it may be recycled to the process.

The hydrocarbon and steam vapor from ejector B is cooled and condensed in heat exchanger E. This liquid flows to accumulator F to separate the hydrocarbon and water phases, as described for accumulator D.

Pump G transfers the naphtha-free tailings to the suction of a main tailings pump for transfer to the plant tailings pond. Pumps H and I transfer the recovered naphtha to a process storage tank, for re-use in the process. Pump J transfers the decanted water from accumulator D to the effluent tailings pond.

It will be noted that approximately 86% of the naphtha originally present in the centrifuge tailings is recovered by the practise of the process.

Obvious variations in the specific details described may be made without departing from the spirit of the invention and such embodiments of the invention as come within the scope and purview of the appended claims are to be considered as part of this invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of recovering hydrocarbon diluent from hot centrifuge tailings produced in the treatment of bitumen froth from the hot water process, which comprises:

introducing the tailings into a vacuum flash vessel maintained at a sufficiently low sub-atmospheric pressure to vaporize the major portion of the contained diluent and some water;

cooling the vapor stream from the flash vessel to produce a fluid mixture of diluent and water; and

separating the diluent and water, whereby the diluent is recovered for recycling.

2. The method as set forth in claim 1 wherein:

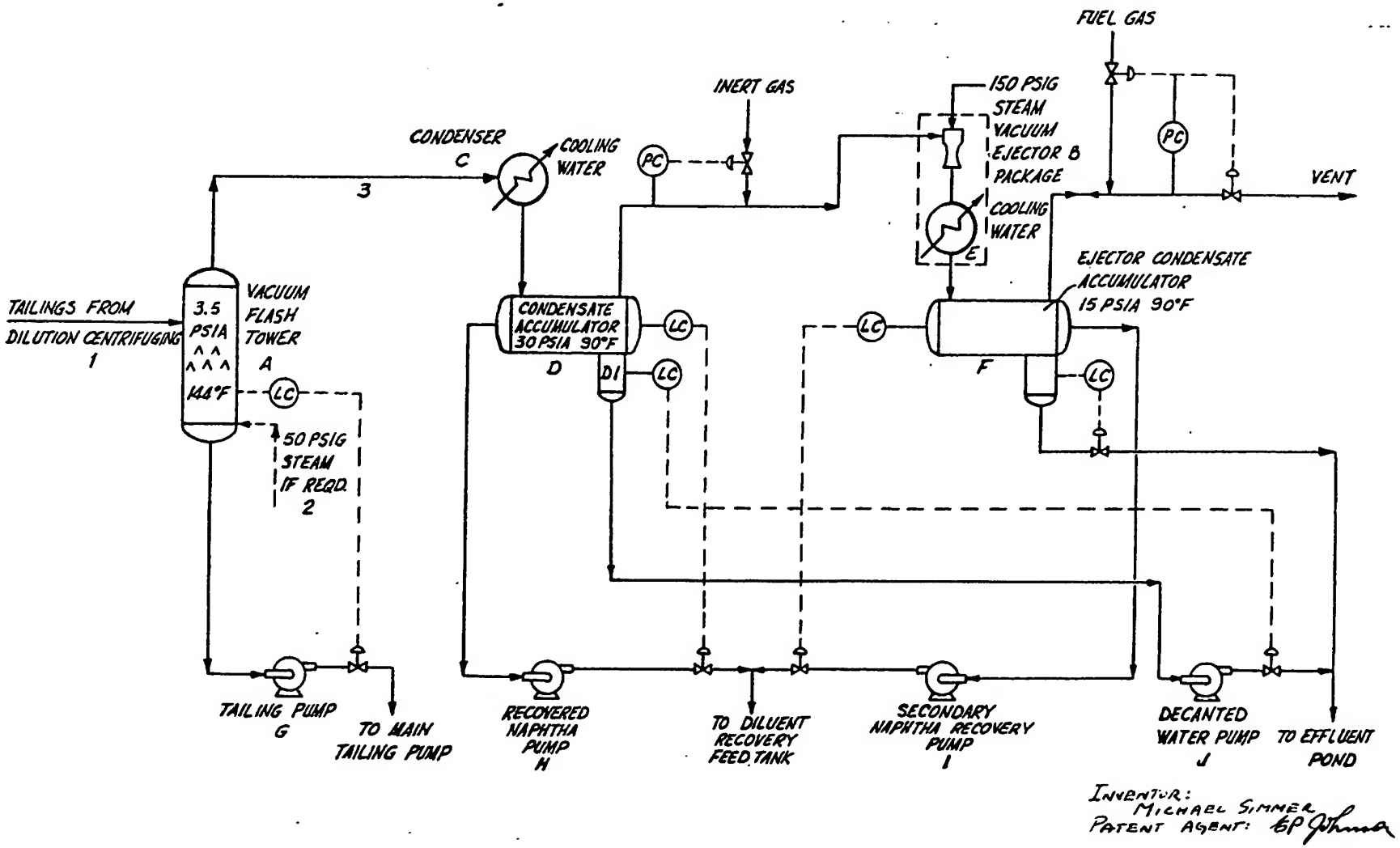
the diluent is naphtha;

the flash vessel is maintained at a pressure of about 2 - 10 psia; and

the fluid mixture is settled to recover the contained naphtha.

3. The method as set forth in claim 2 wherein:

the flash vessel is maintained at a pressure of about 3 - 5 psia.



INVENTOR: MICHAEL SIMMER
PATENT AGENT: EP Johnson